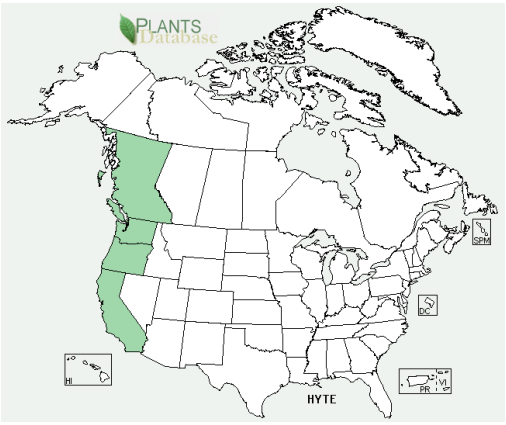
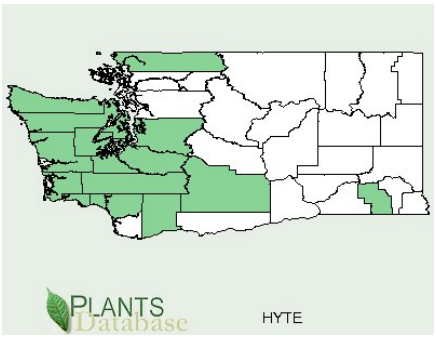
Plant Propagation Protocol for *Hydrophyllum tenuipes*
ESRM 412 – Native Plant Production

TAXONOMY	
Family Names	
Family Scientific Name:	*Hydrophyllaceae*
Family Common Name:	Waterleaf family
Scientific Names	
Genus:	*Hydrophyllum* L.
Species:	*tenuipes*
Species Authority:	A. Heller
Variety:	
Sub-species:	
Cultivar:	
Authority for Variety/Sub-species:	
Common Synonym(s) (include full scientific names (e.g., *Elymus glaucus* Buckley), including variety or subspecies information)	*Hydrophyllum viridulum* G.N. Jones
Common Name(s):	Pacific Waterleaf
Species Code (as per USDA Plants database):	HYTE
GENERAL INFORMATION	

Geographical range (distribution maps for North America and Washington state)	The west coast of North America, including British Columbia, Washington, Oregon, and California[1].   Source: USDA PLANTS database
Ecological distribution:	Found in open moist forests in the Cascade mountains of Washington State, as well as forests spanning the whole distribution.[3] Also found in riparian zones and floodplains with mixed forests.[4]
Climate and elevation range:	Middle to low elevation.[2] Pacific waterleaf is strongly associated with very moist soil regimes.[4]
Local habitat and abundance; may include commonly associated species:	In British Columbia, association with bigleaf maple is common and in Oregon, association with Oregon ash has been noted.[4] Prefers partial to full shade.[2]
Plant strategy type / successional stage:	*H. tenuipes* is both a seral and a climax species.[3] It is an aggressive rhizomatous groundcover and competes for space readily with English ivy.[2]
Plant characteristics:	Pacific waterleaf is a deciduous groundcover that can grow up to two feet. It is a perennial herb from a rhizome and fleshy, fibrous roots. It has hairy basal leaves, divided into 5-9 toothed leaflets. The leaves can be up to 12" long and 8" wide.[2] The flowers emerge in May to June. They range in color from greenish-white to purple. The stamens are very distinct because they extend past the petals.[4]
PROPAGATION DETAILS	
Propagation Goal:	Plants
Propagation Method:	Seed
Product Type:	Bareroot
Stock Type:	Seed
Time to Grow (from seeding until plants are ready to be outplanted):	For best results, seeds should be sown immediately after collection in midsummer.[8]
Target Specifications:	Pacific Waterleaf is a good plant to propagate in shaded gardens or areas because it does not tolerate much sunlight. It is useful as a spreading

	groundcover.[8] Usually it reaches between one and two feet tall. It can be an aggressive grower, so it should be planted next to other similarly aggressive covers.
Propagule Collection:	Seeds should be collected in midsummer, usually late July and early August[8] when the heads begin to yellow and the plants are declining.[7] To confirm that the seeds are mature, split a few open. The inside should be light brown.[8]
Propagule Processing/Propagule Characteristics:	Not found in literature.
Pre-Planting Propagule Treatments:	If seeds are not planted directly after collecting, the seeds should be stored in damp sphagnum moss.[8] To germinate them use a moist-cold stratification at 40ºF for 90 days followed by a shift to 70ºF.[6]
Growing Area Preparation / Annual Practices for Perennial Crops:	Use moist soil high in organic matter in a shaded area.[6] Pacific Waterleaf can tolerate a wide range of soil textures, from sandy loam to heavy clay as long as the soil is sufficiently moist.[9] Sow the seeds as soon as they are collected in midsummer. Not all of the seeds will germinate, but there should be a fair number of plants by next spring.[8] Plants will die back during the dry summer months but will reappear the next spring.[10]
Establishment Phase (from seeding to germination):	Midsummer to early spring of the next year.
Length of Establishment Phase:	8-9 months.
Active Growth Phase:	Early spring to midsummer.
Length of Active Growth Phase:	3-4 months
Hardening Phase:	Not found in literature
Length of Hardening Phase:	Not found in literature
Harvesting, Storage and Shipping:	Not found in literature
Length of Storage:	Not found in literature
Guidelines for Outplanting / Performance on Typical Sites:	Must be planted in shade and it is helpful to use no more than an inch of organic mulch.[5] If seeds are planted directly after collection, allow them to spend the winter undisturbed in the bed. Thin as necessary in the spring. If seeds are planted after storage, there may be no germination until the following spring.[8] Because Waterleaf can also spread through rhizomes, they need to be thinned yearly to avoid plants in unwanted areas. [8]
Other Comments:	Seeds are hydrophilic and will not tolerate dry storage.[6] Because Waterleaf seeds need constant moist soil, the biggest concern for the propagator will be to keep the soil wet enough throughout the winter.[8]
	INFORMATION SOURCES
References (full	[1]USDA PLANTS Database <http://plants.usda.gov>

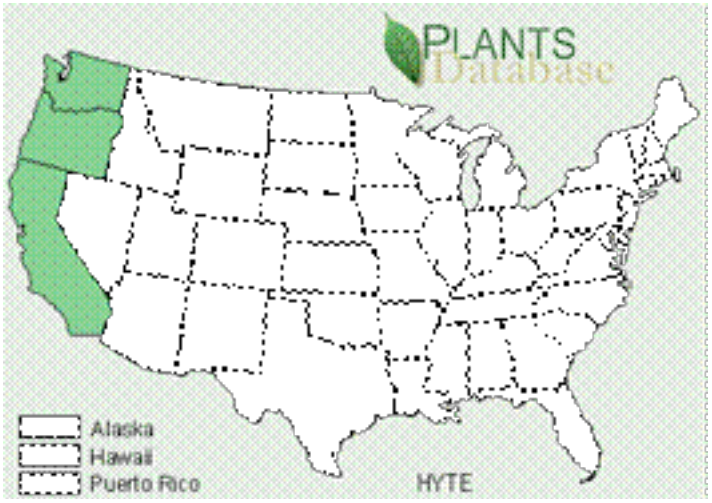
citations):	[2] "Pacific Waterleaf." WSU Clark County Extension PNW Plants, 2011. 18 April 2011. <http://www.pnwplants.wsu.edu/PlantDisplay.aspx?PlantID=306> [3] del Moral, Roger. "Hydrophyllum tenuipes." *University of Washington Department of Biology* 2002. *OAlster.* Web. 18 April 2011. [4] Zevit, Pamela and Matt Fairbarns. "BC's Coast Region: Species & Ecosystems of Conservation Concern Pacific Waterleaf (*Hydrophyllum tenuipes)*." Aug. 2010. <www.geog.ubc.ca/biodiversity/factsheets/pdf/Hydrophyllum_tenuipes.pdf> [5] "Catalog for 2003 and Beyond." Sound Native Plants, 2003. 18 April 2011. <www.soundnativeplants.com/nursery.htm> [6] Cullina, William. *The New England Wild Flower Society Guide to Growing and Propagating Wildflowers of the United States and Canada.* New York: Houghton Mifflin Company, 2000. Print. [7]Armitage, Allan M. *Armitage's Native Plants for North American Gardens.* Portland: Timber Press, Inc., 2006. Print. [8]Phillips, Harry R. *Growing and Propagating Wild Flowers.* Capitol Hill: The University of North Carolina Press, 1985. Print. [9] "Hydrophyllum tenuipes-Heller." Plants for a Future, 2010. 19 April 2011. http://www.pfaf.org/user/Plant.aspx?LatinName=Hydrophyllum%20tenuipes [10] Aoki, Mieko et. Al. "Native Herbaceous Plants in Our Gardens: A Guide for the Willamette Valley." The Native Plant Society of Oregon, 2005. 19 April 2011. <www.wnps.org/landscaping/.../native_alliance_urban_complete.pdf>
Other Sources Consulted (but that contained no pertinent information) (full citations):	"Pacific Waterleaf." King County Native Plant Guide, 2008. 18 April 2011. <http://green.kingcounty.gov/gonative/Plant.aspx?Act=view&PlantID=69>. Beckmann, Robert L. Jr. "Biosystematics of the Genus Hydrophyllum L. (Hydrophyllaceae)." *American Journal of Botany* 66:9 (1979): 1053-1061. Web. 18 April 2011. Pojar, Jim and Andy MacKinnon. *Plants of the Pacific Northwest Coast.* Vancouver, BC: Lone Pine Publishing, 1994. Print. Kozloff, Eugene N. *PLANTS of Western Oregon, Washington & British Columbia.* Portland: Timber Press, Inc., 2005. Print. Robson, Katleen A., Alice Richter, and Marianne Filbert. *Encyclopedia of Northwest Native Plants for Gardens and Landscapes.* Portland: Timber Press, Inc., 2008. Print. Leopold, Donald J. *Native Plants of the Northeast.* Portland: Timber Press, Inc., 2005. Print.

Other Sources Consulted (but that contained no pertinent information) (full citations):	"Pacific Waterleaf." King County Native Plant Guide, 2008. 18 April 2011. <http://green.kingcounty.gov/gonative/Plant.aspx?Act=view&PlantID=69>. Beckmann, Robert L. Jr. "Biosystematics of the Genus Hydrophyllum L. (Hydrophyllaceae)." *American Journal of Botany* 66:9 (1979): 1053-1061. Web. 18 April 2011. Pojar, Jim and Andy MacKinnon. *Plants of the Pacific Northwest Coast.* Vancouver, BC: Lone Pine Publishing, 1994. Print.

Species

Pacific waterleaf, *Hydrophyllum tenuipes* Heller

Tender leaved, fibrous rooted rhizomatous perennial herb to 80 cm tall. Leaves to 25 cm long by 15 cm wide, alternate, 5-9 pinnapalmately lobed with toothed margins. Flowers greenish-white to purple to blue, 5-7 mm long, bell shaped with conspicuous strongly exerted stamens in branched cymes. (1,3)



Range

Moist middle to low elevation forests of SW British Columbia, W Washington, W Oregon and NW California. (1, 3, 4)

Climate, elevation

Moist maritime climate in low to middle elevation forests (1, 3)

Local occurrence

Low to mid elevation Puget Sound area forests and along the western Olympic peninsula coast forests down to the mouth of the Columbia. Found in Seattle in profusion at Golden Gardens Park in the mixed conifer/hardwood understory of steep west facing clayey soiled slopes. (1, 2, 3)

Habitat preferences

Moist, shady open conifer and hardwood forests (1, 3)

Plant strategy type/successional stage

Not found in the literature. Seems to found in fairly mature lowland mixed conifer/hardwood forests indicating it is probably a mid to late successional species. Locally in Golden Gardens, Seattle it seems to be an aggressive rhizomatous spreader capable of competing for space with English ivy (*Hedera helix*).

Associated species

Locally in Golden Gardens Park, Seattle found intermixed in profusion with dull Oregon-grape (*Berberis nervosa*), false Solomon's seal (*Smilacina racemosa*), and fringe-cup (*Tellima grandiflora*). Observed to grow under open structured understory shrubs such as beaked hazelnut (*Corylus californica*), oceanspray (*Holodiscus discolor*) and red elderberry (*Sambucus racemosa*). Pacific waterleaf seems to be less profuse (but present) beneath densely structured shrubs such as salmonberry (*Rubus spectabilis*) and snowberry (*Symphoricarpos albus*). Overstory trees found in Golden Gardens with Pacific waterleaf are western red cedar (*Thuja plicata*), Douglas-fir (*Psuedotsuga menziesii*), big-leaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), western hemlock (*Tsuga heterophylla*) and grand fir (*Abies grandis*).

May be collected as:

Not found in literature. Being a strongly rhizomatous species it can be assumed rhizomes pieces collected in fall would probably be successfully propagated. Seeds probably can also be collected in late summer.

Collection restrictions or guidelines

Typical conservative collection methods for genetic integrity and minimal ecosystem impact probably apply. Foliage is tender so fall/winter collection probably best.

Seed germination

Not found in literature. May need some period of cold stratification typical of Pacific Northwest forest understory species.

Seed life

Not found in literature

Recommended seed storage conditions

Not found in literature. Probably typical low temperature, low humidity conditions

Propagation recommendations

Given its rhizomatous, mat forming habit propagation using rhizome pieces that includes roots as well as shoot buds would probably be successful. Has been propagated in England as a horticultural species though propagation methods were not disclosed.

Soil or medium requirements

Not found in literature. Given its preference for shady, moist understories a standard high organic content potting soil would probably be best.

Installation form

Not found in literature. Second year pot ups would probably be mature enough to install in field. Rhizome transplants directly from donor to restoration site might also be successful.

Recommended planting density

Not found in literature. Where English ivy invasions are a concern close (25cm or less) spacing might be best.

Care requirements after installed

Pacific waterleaf's preference for moist understories would seem to indicate careful weekly watering during the first season would be vital if the installation site's soils were not naturally moist enough.

Normal rate of growth or spread; lifespan

Not found in literature. Seems to be a vigorous moderate to quick spreader. Lifespan unknown but like most perennial clonal species Pacific waterleaf once established probably persists for a long time.

Sources cited

Hitchcock, C. Leo and Cronquist, Arthur. Flora of the Pacific Northwest. 1998. University of Washington Press, Seattle and London.

Kozloff, Eugene. Plants and Animals of the Pacific Northwest. 1978. University of Washington Press, Seattle and London.

Pojar, Jim and McKinnon, Andy, eds. Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia and Alaska. 1994. Lone Pine Press, British Columbia.

USDA PLANTS National Database. http://plants.usda.gov/

Data compiled by

Rodney Pond 04.13.03

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